Structural aspect of high intensity dynamic loading of metal targets

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An experiment was carried out on the dynamic loading of metals in the range of loading intensities typical for situations of accidental collision of aircraft engine fan blades with foreign objects and hardening of the front surface of the material by the action of a shock wave pulse. Target samples made of various materials (titanium, vanadium, zirconium) were loaded by Beamtech SGR-Extra-10 Nd:YAG pulse laser (wavelength 1064 nm; pulse duration 11 ns; pulse energy up to 10 J). Structural analysis of target specimens in the direction of propagation of a shock wave pulse initiated by laser action revealed the possibility of implementing two modes: the mode of shock wave forging at the front surface of targets and the formation of localized damage areas in the bulk of targets. Mechanisms of forging and damage localization are associated with different "adiabatic shear" staging and can be important for the life-time prediction of aircraft engine (fan blades) with application to the Foreign Object Damage problem.

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